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**Exhibit R-2, RDT&E Budget Item Justification:** PB 2019 Office of the Secretary Of Defense **Date:** February 2018

<b>Appropriation/Budget Activity</b> 0400: <i>Research, Development, Test &amp; Evaluation, Defense-Wide I</i> BA 5: <i>System Development &amp; Demonstration (SDD)</i>	<b>R-1 Program Element (Number/Name)</b> PE 0605294D8Z <i>I Trusted and Assured Microelectronics</i>
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COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
Total Program Element	0.000	0.000	61.084	56.178	-	56.178	57.194	67.153	67.107	67.518	Continuing	Continuing
812: <i>Trusted Mask Trust Approach</i>	0.000	0.000	2.000	2.000	-	2.000	2.000	2.000	2.000	2.000	Continuing	Continuing
809: <i>New Trust Approach Demonstration</i>	0.000	0.000	59.084	54.178	-	54.178	55.194	65.153	65.107	65.518	Continuing	Continuing

## A. Mission Description and Budget Item Justification

This Program Element (PE) supports activities to ensure critical and sensitive integrated circuits are available to meet the DoD's needs. It refines strategies and management planning activities that will: (1) provide support to acquisition programs to address trusted and assured microelectronics supply needs; (2) improve capability to evaluate and validate assurance of microelectronic parts and advance standards to incentivize the commercial marketplace to recognize hardware assurance as a competitive design standard; and (3) develop and demonstrate alternative approaches to the DoD Trusted Foundry program to assure the microelectronics supply chain in order to enable broader DoD access to commercial state-of-the-art (SOTA) microelectronics technology.

This activity will be coordinated by the Office of the Under Secretary of Defense for Research and Engineering, and will include performers from the DoD Components, the Defense Microelectronics Activity (DMEA), the Joint Federated Assurance Center (JFAC), the Defense Advanced Research Programs Agency (DARPA), other DoD and Intelligence Community science and technology (S&T) organizations and laboratories, the defense industry, and the broader commercial industrial base. It will integrate the functions of the DoD Trusted Foundry Program, the Trusted Supplier accreditation program, JFAC, and related S&T activities.

This activity implements, maintains, and updates the DoD's long-term microelectronics strategy. Additionally this activity places emphasis on incentivizing and proving new microelectronics technology solutions. Recognizing that a trusted and assured supply of microelectronics is a U.S. Government (USG)-wide concern, this activity will interface with interagency partners to take into account interagency requirements, opportunities for collaboration, and strategic decisions that can be made to limit the overall cost of these requirements to the USG.

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<b>Appropriation/Budget Activity</b> 0400: <i>Research, Development, Test &amp; Evaluation, Defense-Wide I</i> BA 5: <i>System Development &amp; Demonstration (SDD)</i>	<b>R-1 Program Element (Number/Name)</b> PE 0605294D8Z I <i>Trusted and Assured Microelectronics</i>
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<b>B. Program Change Summary (\$ in Millions)</b>	<b>FY 2017</b>	<b>FY 2018</b>	<b>FY 2019 Base</b>	<b>FY 2019 OCO</b>	<b>FY 2019 Total</b>
Previous President's Budget	0.000	61.084	15.481	-	15.481
Current President's Budget	0.000	61.084	56.178	-	56.178
Total Adjustments	0.000	0.000	40.697	-	40.697
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	-			
• Congressional Directed Transfers	-	-			
• Reprogrammings	-	-			
• SBIR/STTR Transfer	-	-			
• Other Program Adjustments	-	-	-0.006	-	-0.006
• Increase for priority requirements	-	-	41.080	-	41.080
• Economic Assumption	-	-	-0.377	-	-0.377

**Change Summary Explanation**

An additional \$41.080 million was added to support the following: secure design environments; electronic data automation (EDA) tools; third-party IP and USG IP development; persistent expertise; SOTA commercial off-the-shelf (COTS) programmable integrated circuit co-development; and assessment of supply security and protection.

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2019 Office of the Secretary Of Defense										<b>Date:</b> February 2018		
<b>Appropriation/Budget Activity</b> 0400 / 5					<b>R-1 Program Element (Number/Name)</b> PE 0605294D8Z / <i>Trusted and Assured Microelectronics</i>				<b>Project (Number/Name)</b> 812 / <i>Trusted Mask Trust Approach</i>			
<b>COST (\$ in Millions)</b>	<b>Prior Years</b>	<b>FY 2017</b>	<b>FY 2018</b>	<b>FY 2019 Base</b>	<b>FY 2019 OCO</b>	<b>FY 2019 Total</b>	<b>FY 2020</b>	<b>FY 2021</b>	<b>FY 2022</b>	<b>FY 2023</b>	<b>Cost To Complete</b>	<b>Total Cost</b>
812: <i>Trusted Mask Trust Approach</i>	0.000	0.000	2.000	2.000	-	2.000	2.000	2.000	2.000	2.000	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		
<b>A. Mission Description and Budget Item Justification</b> <p>This project staffs and supports operation of a new secure (SECRET-level) photomask manufacturing capability at an existing SOTA commercial photomask manufacturing supplier to secure the masks and design IP of acquisition programs when using commercial microelectronic fabrication facilities other than the Trusted Foundry. This capability can be used in conjunction with one or more leading-edge commercial foundries. This capability will address trusted masks at technology node sizes less than 130 nanometers (nm) down to 14nm.</p>												
<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>									<b>FY 2017</b>	<b>FY 2018</b>	<b>FY 2019</b>	
<b>Title:</b> Trusted Mask Trust Approach  <b>FY 2018 Plans:</b> DMEA will provide management and technical support, as required, to procure secure mask data parsing services for the Department, as well as other Federal entities, by upgrading an existing SOTA commercial photomask manufacturing supplier with a Trusted photomask capability to ensure the integrity of the tape-in/mask release, mask manufacturing, and authentication process for photomasks. Starting in FY 2018, a SOTA commercial photomask manufacturing supplier will be equipped with a new secure (SECRET-level) photomask manufacturing capability (note: DMEA is still awaiting receipt of \$7.200 million planned for this effort as part of a FY 2017 Defense Production Act (DPA) Title III project) and staffed to provide the required critical Trusted photomask capabilities.  <b>FY 2019 Plans:</b> Equipping and staffing of the new secure (SECRET-level) photomask manufacturing capability at the SOTA commercial photomask manufacturing supplier will be completed, pending receipt of the DPA Title III funding as planned. DMEA will also continue to provide management and technical support, as required, to procure secure mask data parsing services for the Department, as well as other Federal entities, through operation of this Trusted photomask capability.  <b>FY 2018 to FY 2019 Increase/Decrease Statement:</b> Level of effort is consistent between FY 2018 and FY 2019.									-	2.000	2.000	
<b>Accomplishments/Planned Programs Subtotals</b>									-	2.000	2.000	
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A												

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2019 Office of the Secretary Of Defense		<b>Date:</b> February 2018
<b>Appropriation/Budget Activity</b> 0400 / 5	<b>R-1 Program Element (Number/Name)</b> PE 0605294D8Z / <i>Trusted and Assured Microelectronics</i>	<b>Project (Number/Name)</b> 812 / <i>Trusted Mask Trust Approach</i>
<b>C. Other Program Funding Summary (\$ in Millions)</b>  <b>Remarks</b>  <b>D. Acquisition Strategy</b> N/A  <b>E. Performance Metrics</b> Performance for this project is monitored in the following ways: <ul style="list-style-type: none"><li>• Number of photomasks created using the secure photomask manufacturing capability.</li><li>• Number of acquisition programs using the secure photomask manufacturing capability.</li><li>• Number of technology node sizes supported by the secure photomask manufacturing capability.</li><li>• Number of foundries supported by the secure photomask manufacturing capability.</li></ul>		

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<b>Exhibit R-3, RDT&amp;E Project Cost Analysis:</b> PB 2019 Office of the Secretary Of Defense												<b>Date:</b> February 2018		
<b>Appropriation/Budget Activity</b> 0400 / 5					<b>R-1 Program Element (Number/Name)</b> PE 0605294D8Z / <i>Trusted and Assured Microelectronics</i>					<b>Project (Number/Name)</b> 812 / <i>Trusted Mask Trust Approach</i>				

  

Product Development (\$ in Millions)				FY 2017		FY 2018		FY 2019 Base		FY 2019 OCO		FY 2019 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract
Trusted Mask Trust Approach	MIPR	Defense Microelectronics Activity (DMEA) : California	-	-		2.000	Mar 2018	2.000	Mar 2018	-		2.000	Continuing	Continuing	-
<b>Subtotal</b>			-	-		2.000		2.000		-		2.000	Continuing	Continuing	N/A

  

	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	Cost To Complete	Total Cost	Target Value of Contract
<b>Project Cost Totals</b>	-	-	2.000	2.000	-	2.000	Continuing	Continuing	N/A

  

<b>Remarks</b>
NA

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Exhibit R-4, RDT&E Schedule Profile: PB 2019 Office of the Secretary Of Defense			Date: February 2018
Appropriation/Budget Activity 0400 / 5	R-1 Program Element (Number/Name) PE 0605294D8Z / <i>Trusted and Assured Microelectronics</i>	Project (Number/Name) 812 / <i>Trusted Mask Trust Approach</i>	

	FY 2017				FY 2018				FY 2019				FY 2020				FY 2021				FY 2022				FY 2023			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
<i>Trsuted mask facility operation</i>																												
Trusted mask facility operation																												

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Exhibit R-4A, RDT&E Schedule Details: PB 2019 Office of the Secretary Of Defense		Date: February 2018
Appropriation/Budget Activity 0400 / 5	R-1 Program Element (Number/Name) PE 0605294D8Z / <i>Trusted and Assured Microelectronics</i>	Project (Number/Name) 812 / <i>Trusted Mask Trust Approach</i>

Schedule Details

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
<i>Trsuted mask facility operation</i>				
Trusted mask facility operation	1	2019	4	2023

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Exhibit R-2A, RDT&E Project Justification: PB 2019 Office of the Secretary Of Defense										Date: February 2018		
Appropriation/Budget Activity 0400 / 5					R-1 Program Element (Number/Name) PE 0605294D8Z / <i>Trusted and Assured Microelectronics</i>				Project (Number/Name) 809 / <i>New Trust Approach Demonstration</i>			
COST (\$ in Millions)	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	FY 2020	FY 2021	FY 2022	FY 2023	Cost To Complete	Total Cost
809: <i>New Trust Approach Demonstration</i>	0.000	0.000	59.084	54.178	-	54.178	55.194	65.153	65.107	65.518	Continuing	Continuing
Quantity of RDT&E Articles	-	-	-	-	-	-	-	-	-	-		

## A. Mission Description and Budget Item Justification

This project funds a program of research to develop and demonstrate the next generation, technology-driven approach to microelectronics trust and assurance, to include state-of-the-art (SOTA) microelectronics, to ensure continued access to SOTA microelectronic technologies, while maintaining the required level of assurance in all environments. DoD's ability to access commercial technology for its custom secure, trusted and assured needs is diminishing as SOTA suppliers become fewer and more focused on serving the global commercial market. DoD's technology needs are broad, and relying on a single source supplier is not feasible. Alternative, advanced manufacturing methods, technologies, and design tools are needed to produce secure, trusted and assured SOTA parts from commercial sources and to preserve access to these advanced nodes while protecting DoD and Defense Industrial Base (DIB) IP from exploitation. It is also intended to dramatically improve the capabilities of the JFAC with regard to verification and validation in support of microelectronics assurance.

This program of research will demonstrate innovative design, manufacturing, imaging, tagging, and control and assessment approaches for protecting DoD's microelectronics supply chain and IP, including alternatives for trusted, strategic radiation-hardened electronics in advanced technology nodes for next-generation strategic systems, obfuscation and disaggregation technologies, and other assurance mitigations. It will demonstrate advanced imaging technologies and forensics, Design for Assurance techniques, active hardware assurance controls, electronic component markers, and a data and analysis capability to enable auditing and independent verification and validation of commercial designs. It also demonstrates and implements concepts for the cost-effective production of custom microelectronics in low volumes and protection of sensitive IP from exploitation.

Assurance technologies that can be applied in a broad range of trusted and commercial environments can mitigate the risks associated with sole-source suppliers, and increase the ability of the U.S. Government (USG) to leverage commercial capabilities. The suite of demonstrated technologies, e.g., alternative manufacturing methods and design tools, will enable DoD to obfuscate the purpose of sensitive devices, verify their origin and function, and protect sensitive IP from exploitation even while using the global supply chain for most hardware. In cases where the risk involved precludes that level of commercial collaboration, low-volume manufacturing technologies demonstrated under this project would permit DoD to more cheaply produce low volumes of sensitive microelectronics in trusted environments. The project will also support demonstration of a repository of third-party IP and EDA tools to expedite circuit design and transition promising technologies to use.

This project received additional funding starting in FY 2019 to support microelectronics innovation efforts that both enhance national security as well as the supporting DIB and domestic commercial microelectronics suppliers.

<b>B. Accomplishments/Planned Programs (\$ in Millions)</b>	<b>FY 2017</b>	<b>FY 2018</b>	<b>FY 2019</b>
<b>Title:</b> New Trust Approach Demonstration	-	59.084	54.178



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B. Accomplishments/Planned Programs (\$ in Millions)		FY 2017	FY 2018	FY 2019
<p><b>FY 2018 Plans:</b> Primary activities will include demonstration of acquisition program pilots and technology demonstrations, followed by transition of these capabilities to new programs in the following fiscal years.</p> <p>These activities will mature and evaluate trust technologies and techniques through efforts that may include the conduct of studies, Broad Agency Announcements (BAAs) and other efforts to coordinate research programs across USG research and development (R&amp;D) organizations, academia and industry.</p> <p>This project will engage early on with potential stakeholders to identify potential transition issues and aid in transition through joint collaboration between research teams and stakeholders with a focus on evaluations of prototypes, test articles and beta versions of tools, IP, techniques, methods, etc. and their use in operationally-realistic scenarios.</p> <p><b>FY 2019 Plans:</b> Primary activities will continue to include demonstration of acquisition program pilots and technology demonstrations, followed by transition of these capabilities to new programs in the following fiscal years.</p> <p>These activities will continue to mature and evaluate assurance technologies and techniques through efforts that may include the conduct of studies, BAAs, and other efforts to coordinate research programs across USG R&amp;D organizations, academia and industry.</p> <p>This project will engage early on with potential stakeholders to identify potential transition issues and aid in transition through joint collaboration between research teams and stakeholders with a focus on evaluations of prototypes, test articles and beta versions of tools, IP, techniques, methods, etc. and their use in operationally-realistic scenarios.</p> <p>This project will initiate and support R&amp;D activities in the COTS programmable integrated circuit co-development technical focus area, to include a pilot program to secure design capabilities using commercially-available cloud-based services and supply chain tools with/at commercial co-development partners. These activities with key industry partners will support secure co-design efforts of their components' security features and capabilities that are required to meet future DoD needs.</p> <p><b>FY 2018 to FY 2019 Increase/Decrease Statement:</b> This project received additional funding starting in FY 2019 to support microelectronics innovation efforts that both enhance national security as well as the supporting DIB and domestic commercial microelectronics suppliers.</p>				
Accomplishments/Planned Programs Subtotals		-	59.084	54.178

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<b>Exhibit R-2A, RDT&amp;E Project Justification:</b> PB 2019 Office of the Secretary Of Defense		<b>Date:</b> February 2018
<b>Appropriation/Budget Activity</b> 0400 / 5	<b>R-1 Program Element (Number/Name)</b> PE 0605294D8Z / <i>Trusted and Assured Microelectronics</i>	<b>Project (Number/Name)</b> 809 / <i>New Trust Approach Demonstration</i>
<b>C. Other Program Funding Summary (\$ in Millions)</b> N/A		
<b>Remarks</b>		
<b>D. Acquisition Strategy</b> N/A		
<b>E. Performance Metrics</b> Performance for this project is monitored in the following ways: <ul style="list-style-type: none"><li>• Effectiveness of developed technologies, as measured by:<ul style="list-style-type: none"><li>- The speed and reliability of new validation and verification techniques in identifying known microelectronics issues (e.g., tampering) in laboratory and non-laboratory situations.</li><li>- Successful testing of advanced, alternative manufacturing techniques, such as disaggregated manufacturing.</li><li>- Resilience of microelectronics protected by new trust approach technologies in red teaming exercises.</li></ul></li><li>• Adoption of next-generation assurance technologies, as measured by:<ul style="list-style-type: none"><li>- The number of DoD and other USG programs employing these assurance technologies, design approaches, or best practices.</li><li>- The volume and criticality of components employing these technologies, design approaches, or best practices.</li><li>- Promulgation in DoD guidance and program protection plans.</li></ul></li></ul>		

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<b>Exhibit R-3, RDT&amp;E Project Cost Analysis:</b> PB 2019 Office of the Secretary Of Defense												<b>Date:</b> February 2018		
<b>Appropriation/Budget Activity</b> 0400 / 5						<b>R-1 Program Element (Number/Name)</b> PE 0605294D8Z / <i>Trusted and Assured Microelectronics</i>				<b>Project (Number/Name)</b> 809 / <i>New Trust Approach Demonstration</i>				

  

Product Development (\$ in Millions)				FY 2017		FY 2018		FY 2019 Base		FY 2019 OCO		FY 2019 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Prior Years	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract
New Trust Approach Demonstration Program Support	MIPR	Various (DARPA, Air Force, Army, Navy, NSA) : Various	-	-		59.084	Mar 2018	54.178	Mar 2019	-		54.178	Continuing	Continuing	-
<b>Subtotal</b>			-	-		59.084		54.178		-		54.178	Continuing	Continuing	N/A

  

<b>Remarks</b> NA															
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	Prior Years	FY 2017	FY 2018	FY 2019 Base	FY 2019 OCO	FY 2019 Total	Cost To Complete	Total Cost	Target Value of Contract
<b>Project Cost Totals</b>	-	-	59.084	54.178	-	54.178	Continuing	Continuing	N/A

  

<b>Remarks</b> N/A									
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Exhibit R-4, RDT&E Schedule Profile: PB 2019 Office of the Secretary Of Defense			Date: February 2018
Appropriation/Budget Activity 0400 / 5	R-1 Program Element (Number/Name) PE 0605294D8Z / <i>Trusted and Assured Microelectronics</i>	Project (Number/Name) 809 / <i>New Trust Approach Demonstration</i>	

	FY 2017				FY 2018				FY 2019				FY 2020				FY 2021				FY 2022				FY 2023			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
<b><i>New Trust Approach Demonstration</i></b>																												
FPGA integrated assurance analysis/logical and physical verification tool demonstration																												
Automated design and verification and demonstration																												
Validation of custom integrated circuits and demonstration																												
Cloud hardware emulation/virtual instrumentation																												
Classified Technology Demonstrator																												
Third Party Intellectual Property (IP) and EDA tool repository development and demonstration																												
JFAC technical capability improvement development and demonstration																												
Microelectronics assurance and supply chain demonstrations																												
USG and industry engagement																												
Microelectronics assurance and supply chain policy and guidance development/update																												
Management/Technical Support																												

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<b>Exhibit R-4A, RDT&amp;E Schedule Details:</b> PB 2019 Office of the Secretary Of Defense			<b>Date:</b> February 2018
<b>Appropriation/Budget Activity</b> 0400 / 5	<b>R-1 Program Element (Number/Name)</b> PE 0605294D8Z / <i>Trusted and Assured Microelectronics</i>	<b>Project (Number/Name)</b> 809 / <i>New Trust Approach Demonstration</i>	

**Schedule Details**

Events by Sub Project	Start		End	
	Quarter	Year	Quarter	Year
<b><i>New Trust Approach Demonstration</i></b>				
FPGA integrated assurance analysis/logical and physical verification tool demonstration	1	2018	4	2023
Automated design and verification and demonstration	2	2019	2	2020
Validation of custom integrated circuits and demonstration	1	2018	4	2023
Cloud hardware emulation/virtual instrumentation	1	2018	4	2023
Classified Technology Demonstrator	1	2019	2	2020
Third Party Intellectual Property (IP) and EDA tool repository development and demonstration	1	2018	4	2023
JFAC technical capability improvement development and demonstration	1	2018	4	2023
Microelectronics assurance and supply chain demonstrations	1	2018	4	2023
USG and industry engagement	1	2018	4	2023
Microelectronics assurance and supply chain policy and guidance development/update	1	2018	4	2023
Management/Technical Support	1	2018	4	2023